

PCT

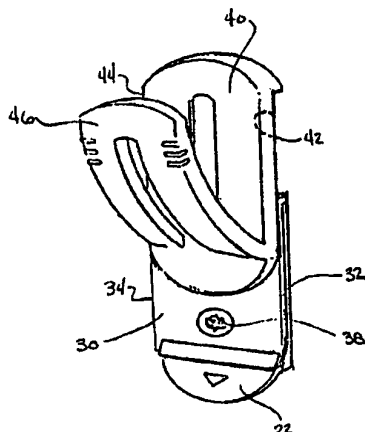
WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>5</sup> : <b>A47G 1/17, F16B 47/00</b>	<b>A1</b>	(11) International Publication Number: <b>WO 94/21157</b> (43) International Publication Date: <b>29 September 1994 (29.09.94)</b>
(21) International Application Number: <b>PCT/US93/02643</b> (22) International Filing Date: <b>23 March 1993 (23.03.93)</b> (71) Applicant: <b>MINNESOTA MINING AND MANUFACTURING COMPANY [US/US]; 3M Center, P.O. Box 33427, Saint Paul, MN 55133-3427 (US).</b> (72) Inventors: <b>HAMERSKI, Michael, D.; P.O. Box 33427, Saint Paul, MN 55133-3427 (US). BRIES, James, L.; P.O. Box 33427, Saint Paul, MN 55133-3427 (US). RODRIGUES, Alex, Jr.; P.O. Box 33427, Saint Paul, MN 55133-3427 (US). CARLSON, Bruce, W.; P.O. Box 33427, Saint Paul, MN 55133-3427 (US).</b> (74) Agents: <b>HOHENSHELL, Jeffrey, J. et al.; Minnesota Mining and Manufacturing Company, Office of Intellectual Property Counsel, P.O. Box 33427, Saint Paul, MN 55133-3427 (US).</b>		(81) Designated States: <b>JP, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</b>  <b>Published</b> <i>With international search report.</i>

(54) Title: **ARTICLE SUPPORT USING STRETCH RELEASING ADHESIVES**



(57) Abstract

An article support adapted for adhering to a substrate is described. The article support preferably includes a base member (30), a stretch release adhesive tape adhered to that base member, and some mechanism (22) for gripping the stretch release adhesive tape. These items are arranged so that when the base member is adhered to the substrate by the stretch release adhesive tape, the base member can be removed by pulling on the gripping means at an acute angle from the surface of the substrate. Gripping means which resist disassociation from the stretch release adhesive tape during the removal of the base from the substrate are disclosed, including handle types. The base member can be generic, suitable for attaching various types of support members (40) via, for example, complimentary dovetail slides (42, 44). In such cases, provision such as a latch can be made to temporarily lock the support member to the base member. The article support can be provided so that when the support member is removed from the base member, the gripping mechanism engages the support member to automatically stretch the tape and remove the base member from the substrate.

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	GB	United Kingdom	MR	Mauritania
AU	Australia	GE	Georgia	MW	Malawi
BB	Barbados	GN	Guinea	NE	Niger
BE	Belgium	GR	Greece	NL	Netherlands
BF	Burkina Faso	HU	Hungary	NO	Norway
BG	Bulgaria	IE	Ireland	NZ	New Zealand
RJ	Benin	IT	Italy	PL	Poland
BR	Brazil	JP	Japan	PT	Portugal
BY	Belarus	KE	Kenya	RO	Romania
CA	Canada	KG	Kyrgyzstan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LV	Latvia	SN	Senegal
CN	China	MC	Monaco	TD	Chad
CS	Czechoslovakia	MD	Republic of Moldova	TG	Togo
CZ	Czech Republic	MG	Madagascar	TJ	Tajikistan
DE	Germany	ML	Mali	TT	Trinidad and Tobago
DK	Denmark	MN	Mongolia	UA	Ukraine
ES	Spain			US	United States of America
FI	Finland			UZ	Uzbekistan
FR	France			VN	Viet Nam
GA	Gabon				

- 1 -

**ARTICLE SUPPORT USING STRETCH RELEASING ADHESIVES****Technical field**

This invention relates to article supports, and  
5 more particularly to articles supports adapted to be  
rapidly adhered and removed from a surface.

**Background**

Hooks and other article supports are commonly  
10 used in both households, institutions, and industry for  
a variety of purposes such as hanging pictures, towels,  
garments, tools, calendars, posters and other articles.  
Conventional hooks often require forming holes in  
cabinets, walls, or the like as fasteners such as screws  
15 or nails are used for attaching them. Alternatively,  
hooks may be adhered by adhesive tapes, but tapes that  
have strong holding power are typically difficult to  
remove cleanly from the wall without scraping or  
otherwise damaging the surface of the wall.

20 Coassigned and copending U.S. patent  
application U.S.S.N. 07/802,061 entitled, "Removable  
Adhesive Tape", and PCT International Application No.  
PCT/US91/09472, to Kreckel et al., disclose a stretch  
releasing adhesive tape. Those documents are herein  
25 expressly incorporated by reference.

Those documents disclose an easily removable,  
pressure-sensitive adhesive tape comprising a highly  
extensible, substantially non-recovering backing.

The tape is capable of being firmly bonded to  
30 a substrate and removed therefrom by being stretched at  
an angle of no greater than about 35 degrees from the  
surface of the substrate. A problem associated with this  
type of tape is that some persons find it difficult to  
grasp for removal. An uncomfortable amount of finger  
35 pressure may be required to grip the tape firmly enough  
to allow removal.

- 2 -

**Brief Description of the Invention**

The present invention advances the field by providing a very convenient way to adhere, and later cleanly remove, article supports to substrates such as walls, windows and cabinetry. Stated generally, the invention can be described as an article support adapted to adhere to a substrate. The article support includes a base member, a stretch release adhesive tape adhered to that base member, and some means for gripping the stretch release adhesive tape. These items are arranged so that when the base member is adhered to the substrate by the stretch release adhesive tape, the base member is capable of being removed from the substrate by gripping the gripping means and stretching the stretch release adhesive tape at an angle no greater than about 35 degrees from the surface of the substrate. The gripping means preferably resists disassociation from the stretch release adhesive tape during the act of removal. In many practical embodiments, the stretch release adhesive tape will be provided with a layer of release liner to protect the adhesive (e.g. from dirt, dust and other matter which will deliteriously affect the adhesive) until the article support is to be used.

The stretch release adhesive tape will have a backing, and at least one layer of adhesive; most commonly it will have two layers of adhesive. The backing may be a singular layer, or it may be two or more layers laminated together as long as the base member is capable of being removed from the substrate by gripping the gripping means and stretching the stretch release adhesive tape at an angle no greater than about 35 degrees from the surface of the substrate.

In one group of embodiments, the above discussed gripping means is a handle, and the stretch release adhesive tape is adhered to the handle around a surface conformed so as to compress at least a portion of the tape during the removal. While many physical

- 3 -

arrangements which achieve this are possible, good results are achieved when the stretch release adhesive tape is wrapped around a portion of said handle in such a manner that the stretch release adhesive tape makes a substantially 180 degree bend. A suitable handle may also have features which make it comfortable to grasp with the fingers; for example, a "D-shaped" ring with the stretch release adhesive tape wrapped around the flat of the "D" shape.

10 In many of the most convenient embodiments, the base member will be rather generic, suitable for attaching various classes of support member such as hooks, towel racks, picture frame supports, or the like. In these embodiments, the base member will comprise a means for attaching such a support member. Conveniently, 15 such an attaching means may be a pair of complimentary dovetail slides on each of the base member and the support member. Other expedients will suggest themselves to the skilled artisan.

20 In embodiments which have a means for attaching a support member, it may be convenient to have a means for locking the support member to the base member, either releasably or permanently. Conveniently, a releasable latch may serve as the locking means.

25 Sometimes it will be convenient to provide an article support such that when the support member is removed from the base member, the gripping means need not be pulled by the fingers, but instead engages the support member as it, for example, slides along a dovetail slide. 30 Then the stretch release adhesive tape is automatically stretched as the support member is pulled so as to remove the base member from the substrate.

As an aid in removal of the stretch release adhesive tape from the substrate, the base member may 35 conveniently have indicia explaining the action involved in removing said base member from the substrate. In those embodiments where the base member has a means for

- 4 -

attaching a support member, it may be particularly preferred that such indicia are placed where they are hidden from view when the support member is attached to the base member, but visible when the support member is removed.

In some embodiments of the invention, it may be desirable to have the support member support a substantial amount of weight -- more than can be supported by the holding strength of a single base member. This can be accommodated within the definition of the invention by providing a support member that is adapted to engage a plurality of base members that are generally oriented in a single plane simultaneously.

In other embodiments a specialized support member can be provided that is adapted to engage a plurality of base members simultaneously in a way that has the stretch release adhesive tape on the base members oriented in more than one plane. In particular, such a support member can hold two inexpensive, generic base members back-to-back so that e.g. a clock can be adhered to a wall. When desired the stretch release adhesive tape makes it possible to remove the base members cleanly from each substrate, and the object adhered can be taken down temporarily for use or maintenance.

Although for many of the applications which are contemplated for the present invention the base member will be rigid, article supports where the base member is a bendable, but not significantly stretchable film, are also considered within the definition of the invention. Such a construction will be useful for e.g. removable labels.

#### Brief Description of the Drawings

A more complete understanding of the invention and its advantages will be apparent from the Detailed Description taken in conjunction with the accompanying Drawings, in which:

- 5 -

Fig. 1 is a plan view of a length of stretch release adhesive tape adhered to a handle, the handle being one way the gripping means can be embodied;

Fig. 2 is a side view of the arrangement shown in Fig. 1;

Fig. 3 is the view of Fig. 2, except that the stretch release adhesive tape is shown under a tensile load, so that the compression of a portion of the tape can be depicted;

Fig. 4 is a perspective view of a base member provided with a double stick stretch release adhesive tape adhered to a D-shaped handle member used as a means for gripping the tape;

Fig. 5 is a side view of the embodiment of Fig. 4;

Fig. 6 is a perspective view of an article support according to the present invention showing a support member being attached to a base member;

Fig. 6a is a top view of the embodiment of Fig. 6;

Fig. 7 is a perspective view of an alternate embodiment of the present invention with the support member partially disengaged from its

base member, in which the stretch release adhesive tape is automatically stretched as the support member is pulled so as to remove the base member from the substrate;

Fig. 8 is the embodiment of Fig. 7 illustrating the support member completely disengaged from the base member, and being used to pull the stretch release adhesive tape;

Fig. 9 is the scene of Fig. 8 with the reverse angle shown so as to emphasize the way the stretch release adhesive tape debonds from the base member;

Fig. 10 is a perspective view of an alternate embodiment of the invention in which the support member

- 6 -

is adapted to engage a two base members oriented in a single plan simultaneously; and

Fig. 11 is an exploded perspective view of an alternate embodiment of the invention in which the support member is adapted to engage two base members so that the stretch release adhesive tape on the two base members are oriented back-to-back.

#### Detailed Description

Referring to Fig. 1, a plan view of a length of stretch release adhesive tape 20 adhered by a layer of pressure sensitive adhesive 21 to a handle 22 is illustrated. The handle 22 serves as a gripping means capable of resisting disassociation from stretch release adhesive tape 20 when the handle is pulled to put the stretch release adhesive tape under a tensile load. Depending on the exact function for which the stretch release adhesive tape 20 is to be used, a second layer of pressure sensitive adhesive 23 will often be present. It will be seen that a portion 24 of the stretch release adhesive tape 20 is adhered to the handle 22 around a surface 26 conformed so as to compress at least a portion of the stretch release adhesive tape during such tensile loading.

Referring to Fig. 2, it will be seen that the stretch release adhesive tape 20 is wrapped around the surface 26 of said handle 22 in such a manner that the stretch release adhesive tape makes an angle with respect to itself, so long as the tape 20 does not disassociate from the handle 22. Preferably the angle is substantially 180 degrees. Referring to Fig. 3 the stretch release adhesive tape 20 is shown under a tensile load, so that the compression of portion 24 can be readily visualized.

Referring now to Fig.'s 4 and 5, a perspective view of a base member 30 is illustrated. This base member 30 is provided with a double stick stretch release



- 7 -

adhesive tape (adhesive to the back and not readily seen in this view). This double stick stretch release adhesive tape also is inserted through and wrapped around an opening of a generally "D-shaped" handle also designated as reference character 22. It will be observed that the tape 20 makes a 180 degree bend back along itself.

The base member 30 depicted here is deliberately intended to be highly generic, suitable for attaching various classes of support member. For this purpose the base member 30 has the male half of a dovetail slide, the two portions of which are designated 32 and 34, so that these slides can serve as a means for attaching such a support member.

A direction arrow 36 shows the direction of pulling on the gripping means 22 which will serve to remove the base member 30 from a substrate. The depicted base member 30 has indicia 38 printed on it to conveniently explain the action involved in removing the base member from the substrate. For example, the indicia may comprise pictographs or icons for indicating that handle should be pulled approximately directly down to remove the tape 20 (and thus the base 30) from the substrate. In Fig. 5, the dovetail 32 can more readily be seen, and direction arrow 36 is able to more clearly indicate that the stretch release adhesive tape 20 is to be pulled at an angle of no greater than 35 degrees to remove the base member 30 from the substrate.

Referring to Fig. 6, the base member 30 depicted in Fig. 5 is again shown in perspective view, this time with an article support 40 being attached to the base member using a sliding engagement between the male dovetail slides 32 and 34 on the base member and female dovetail slides 42 and 44 on the support member. The support member 40 is depicted with a rounded hook 46, indicating that that representation be considered illustrative of many functionalities which could

- 8 -

alternatively be used. Other examples of support members include catches, hook and loop fasteners, eyelets, magnets, corkboard, suction cups, ribs and other such structures. In Fig. 6a, the interaction between the male dovetail slides 32 and 34 on the base member and female dovetail slides 42 and 44 on the support member can more readily be seen.

Referring to Fig. 7, a perspective view of an alternate embodiment of the present invention in which the stretch release adhesive tape 20 is automatically stretched as the support member 40 is removed from the base member 30, so as to at the same time remove the base member from the substrate. The support member 40 is shown partly slid down the base member 30; in this embodiment, a releasable latch 48 serves as a means for locking the support member to the base member, acting on a recess 49. The base member 30 and the support member 40 are free to slide past each other via the dovetail slides 32, 34, 42, and 44 when the releasable latch is depressed away from recess 49. The handle 22 has just engaged a ledge 50 in this figure, so that the stretch release adhesive tape 20 will be pulled as the support member 40 is disengaged from the base member 30.

In Fig. 8, the action depicted in Fig. 7 has proceeded, with the support member 40 completely disengaged from the base member 30, and being used to pull the stretch release adhesive tape 20. In Fig. 9, this same scene is shown from the reverse angle, emphasizing the way the stretch release adhesive tape 20 debonds from the base member 30, and similarly from any substrate to which the base member is adhered. Along the debond line 52, the backing of the stretch release adhesive tape 20 is yielding, and this physical action arranges that only a tiny amount of the adhesive layers 21 and 23 are asked to debond at any one time, reducing the chances that the substrate will be damaged by the removal. It will be particularly observed that stretch

- 9 -

stretch release adhesive tape 20 is bent around handle 22 forming a substantially 180 degree bend.

Referring now to Fig. 10 a perspective view of an alternate embodiment of the invention in which the support member 40 is adapted to engage a plurality of base members simultaneously is illustrated. A second base member 30a is depicted, with parts analogous to those of base member 30 showing an "a" suffix. Base members 30 and 30a in this embodiment have simply been adhered side by side, and a wider support member 46 engaged to both of them simultaneously, dovetail slides 32 and 34a becoming superfluous in this arrangement. Other arrangements will readily suggest themselves in the light of this teaching, where two or more base members which are identical for ease of manufacturing and inventorying are set up in a prearranged pattern on the substrate, and a single support member engages all of them simultaneously. It should be appreciated that an advantage to using several similar generic base members is that a limited width of tape is debonded at any one time which further reduces the chance of damage to the substrate.

Referring now to Fig. 11, an exploded perspective view of an alternate embodiment of the invention is illustrated. In this view, a support member 54 is seen which is adapted to engage two similar base members 30 and 30a so that the stretch release adhesive tape 20 and 20a with their gripping means 22 and 22a on the two base members are oriented back-to-back. With the depicted device, an appliance such as a clock can be mounted on a wall, with one base member adhered to the clock and the other base member adhered to the wall. Gravity and physical interference suffice to hold both base members in the specialized support member. However, the clock is easily dismounted for winding or the like by lifting its adhered base member out of the support member. When such mounting is no longer desired the

- 10 -

stretch release adhesive tape makes it possible to remove the base members cleanly from both the clock and the wall.

It will be noted that one of the advantages of the present invention is that when a separate base member and support member are used, each can be optimized for its purpose, with different materials and manufacturing methods used. For example, a highly generic base element which will be visually concealed by a decorative support element may be made of materials which balance the properties of low cost and good adhesion to the stretch release adhesive tape. Polyethylene or polypropylene, extruded with a shape possessing an appropriate dovetail cross-section is considered particularly preferred for these applications.

In contrast, the support member need not be optimized for adhesion, and depending on the contemplated use other desirable properties may be selected for such as cost, surface appearance, suitability for accepting decorative plating, bending strength, ability to be readily injection molded, etc. Depending on the exact application, rigid polyvinyl chloride, high impact polystyrene, or nylon could be advantageously used.

In the interest of a complete presentation, illustrative examples of suitable stretch release adhesive tapes will be presented. U.S.S.N. 07/802,061 Removable Adhesive Tape to Kreckel, and PCT Application No. PCT/US91/09472 previously incorporated by reference, provide a more complete discussion of alternatives. Additional background on styrene-butadiene block copolymer adhesives which are useful in the context of the present invention can be found in coassigned U.S. Patents 4,699,842 and 4,835,217, both to Jorgensen et al, both pressure sensitive adhesives having a broad useful temperature range, both of which are hereby incorporated by reference.

- 11 -

**Example 1**

An adhesive was made by partially polymerizing 100 g of a blend containing 90% by weight isooctylacrylate monomer and 10% by weight acrylic acid monomer and 0.04 part per hundred 2,2-dimethoxy-2-phenyl acetophenone ("Irgacure 651") to yield a coatable syrup having a viscosity of about 5,000 cps. To this syrup was then added an additional 0.25 g of a blend containing 90% by weight isooctylacrylate monomer and 10% by weight acrylic acid monomer and 0.04 part per hundred 2,2-dimethoxy-2-phenyl acetophenone ("Irgacure 651"), plus 0.125 g of 1,6-hexanediol diacrylate crosslinking agent. The composition was thoroughly mixed and coated onto a silicone-coated polyester film by means of a knife coater adjusted to produce an adhesive thickness of 0.125 mm. After the coated syrup was purged thoroughly with nitrogen gas, it was covered with a second silicone-coated polyester film and polymerized by means of ultraviolet radiation using a total energy of 450 mJ/cm<sup>2</sup>. One layer of the adhesive was then laminated to each side of a 0.05 mm corona treated linear low density polyethylene film, forming a double-coated adhesive tape. The linear low density polyethylene film, commercially available from Consolidated Thermoplastics Co., had an elastic modulus of 28,968 psi, a 50% modulus of 4,000 psi, a yield stress of 1743 psi, a yield strain of 17.3%, a tensile strength of 7,931 psi, an elongation of 748%, and a recovery of 5.4%.

30

**Examples 2-6**

Adhesive tapes were made generally according to Example 1, but the level of cross-linking agent was varied. Examples were made having crosslinker levels of 0.01, 0.025, 0.05, 0.10 and 0.18 percent. The adhesives so made were discovered to evidence a range of stretch release adhesion properties.

- 12 -

**Exempl 7**

A styrene-butadiene block copolymer adhesive was knife coated onto a silicone release liner, then dried at 175 degrees F for 15 minutes in a forced air drying oven. Adhesive films of 2.8 mil (0.07 mm) and 4.6 mil (0.14 mm) in thickness were thus made.

While certain embodiments of the present invention have been described in detail herein and as shown in the accompanying Drawings, it will be evident that various further modifications are possible without departing from the scope of the invention.

- 13 -

What is claim d is:

1. An article support adapted for adhering to a substrate, comprising:
  - a base member;
  - 5 a stretch release adhesive tape adhered to the base member; and
  - means for gripping said stretch release adhesive tape, wherein
  - when said base member is adhered to the
  - 10 substrate by said stretch release adhesive tape, said base member is capable of being removed from the substrate by gripping the gripping means and stretching the stretch release adhesive tape at an angle no greater than about 35 degrees from the surface of the substrate,
  - 15 said gripping means resisting disassociation from said stretch release adhesive tape during the removal.
2. An article support according to claim 1 wherein said gripping means comprises a handle, wherein
- 20 said stretch release adhesive tape is adhered to the handle around a surface conformed so as to compress at least a portion of the tape during the removal.
3. An article support according to claim 2
- 25 wherein said stretch release adhesive tape is wrapped around a portion of said handle in such a manner that said stretch release adhesive tape makes a substantially 180 degree bend.
4. An article support according to claim 2
- 30 wherein said handle is generally D-shaped.
5. An article support according to claim 1 further comprising a support member, and wherein said
- 35 base member comprises a means for attaching said support member.

- 14 -

6. An article support according to claim 5 wherein said attaching means comprises a pair of complimentary dovetail slides on each of said base member and said support member.

5

7. An article support according to claim 5 wherein said attaching means comprises a means for locking said support member to said base member.

10

8. An article support according to claim 7 wherein said locking means is a releasable latch.

9. An article support according to claim 5 wherein when said support member is removed from said  
15 base member, said gripping means engages said support member so that said stretch release adhesive tape is stretched so as to remove said base member from the substrate.

20

10. An article support according to claim 1 wherein said base member has indicia explaining the action involved in removing said base member from the substrate.

25

11. An article support according to claim 10 wherein said base member comprises a means for attaching a support member, and wherein said indicia are hidden from view when said support member is attached to said base member.

30

12. An article support according to claim 5 wherein said support member is adapted to engage a plurality of base members simultaneously.

35

13. An article support according to claim 12 wherein said support member is adapted to engage said plurality of base members so that said stretch release



- 15 -

adhesive tape on each of said base members are oriented in a single plane.

14. An article support according to claim 12 wherein said support member is adapted to engage said plurality of base members so that said stretch release adhesive tape on said base members are oriented in more than one plane.

10 15. An article support according to claim 1 wherein said stretch release adhesive tape comprises a backing and at least one layer of adhesive adhered thereto.

15

1 / 7

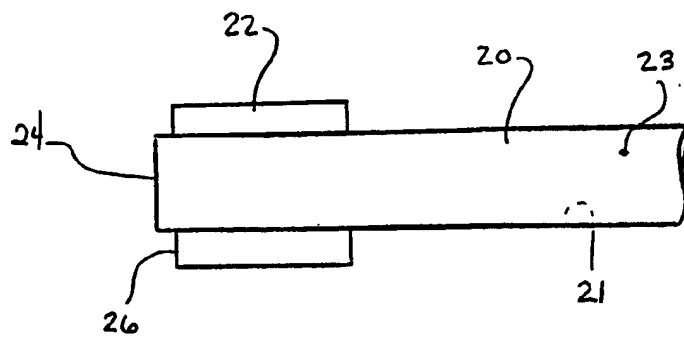


Fig. 1

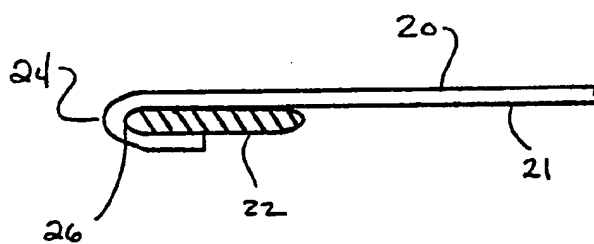


Fig. 2

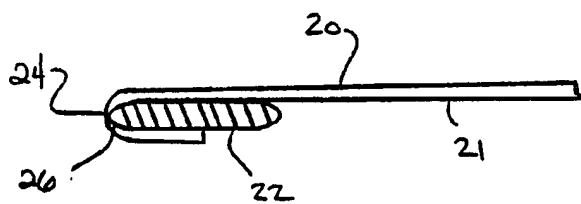


Fig. 3

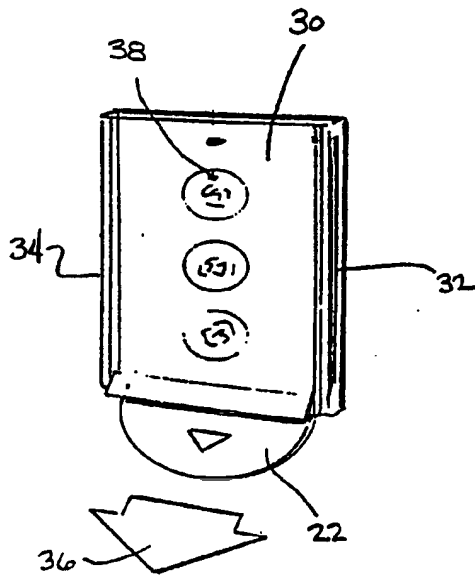


Fig. 4

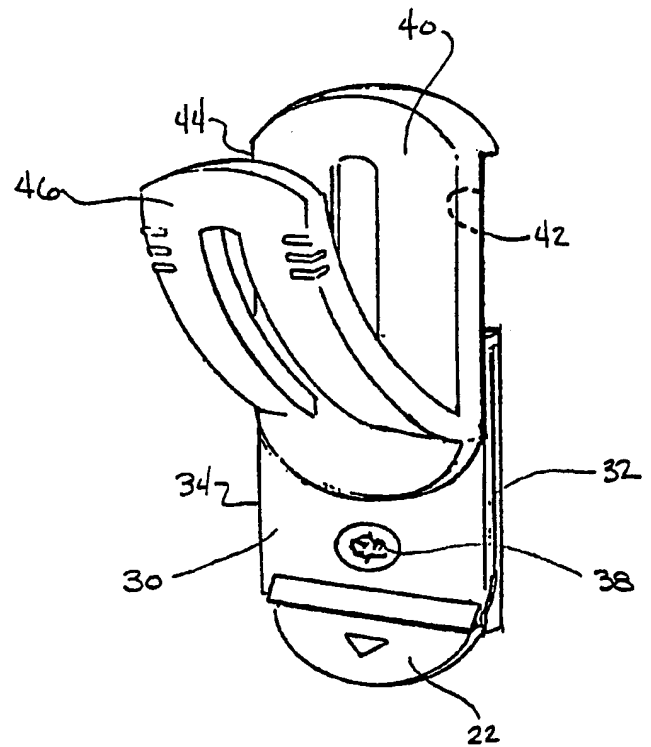


Fig. 6

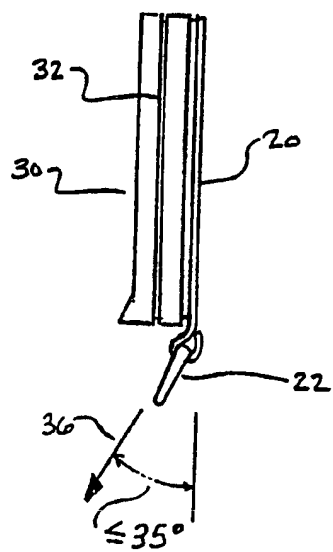


Fig. 5

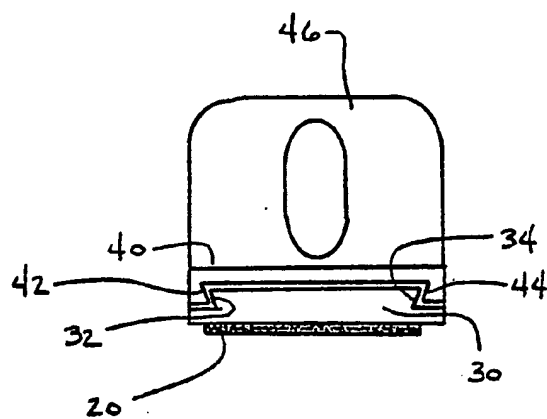
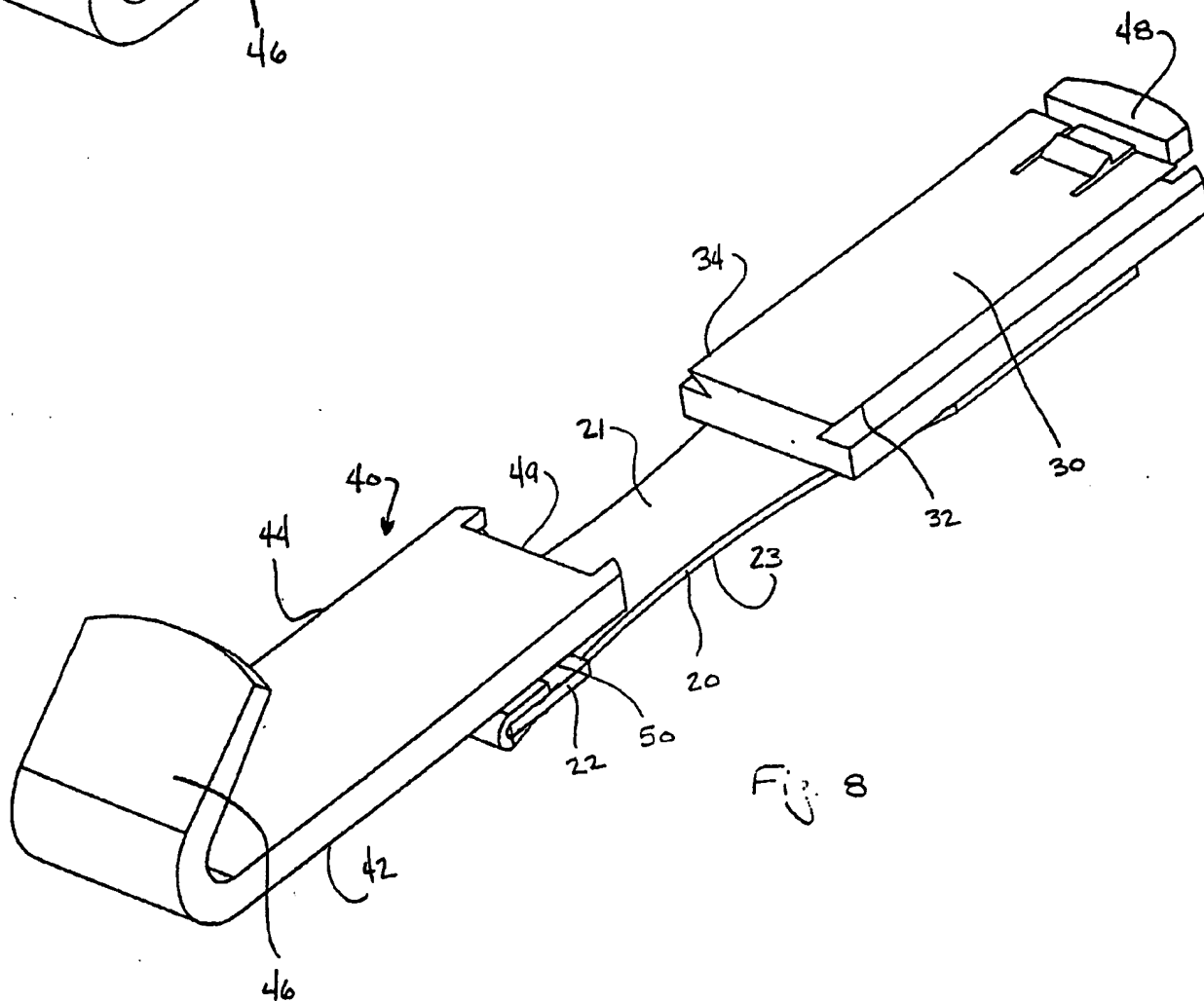
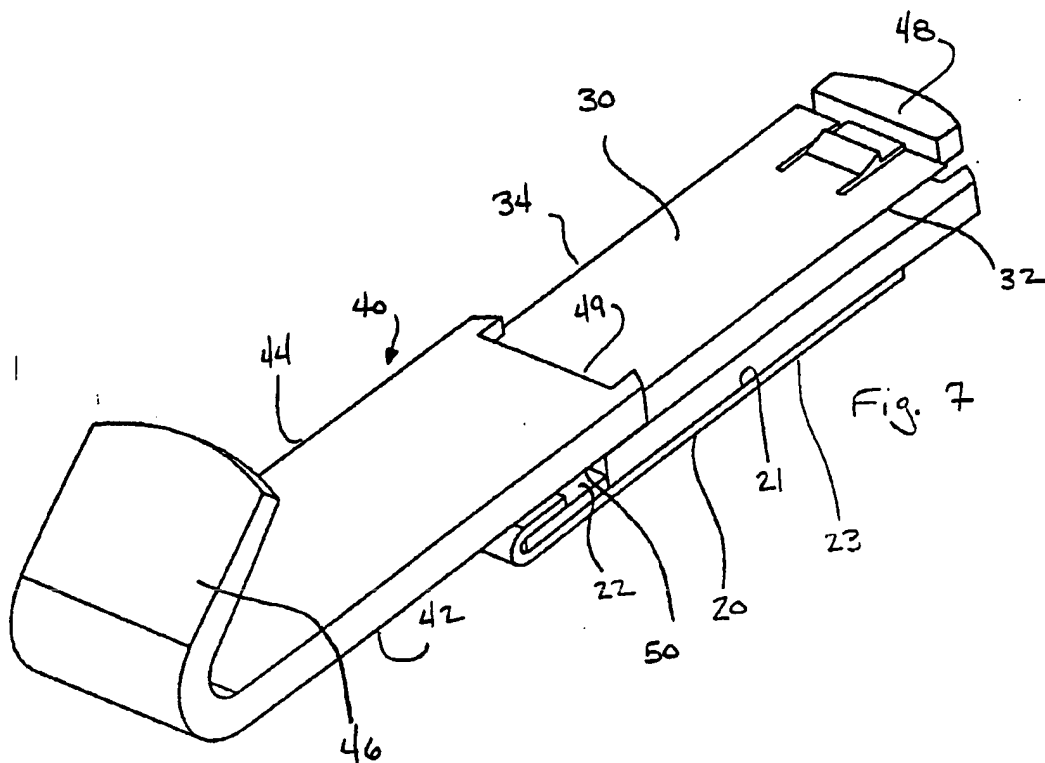
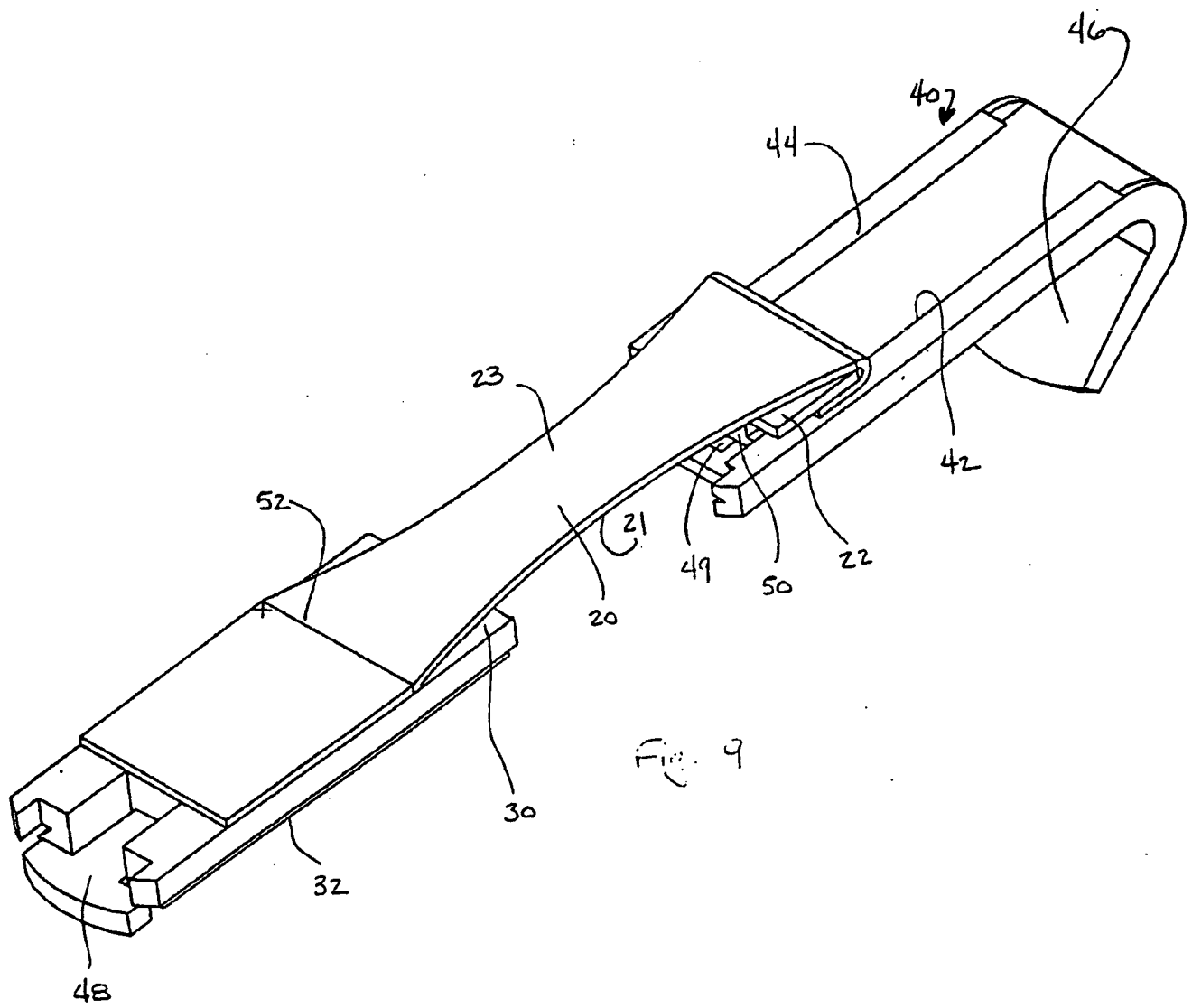


Fig 6a





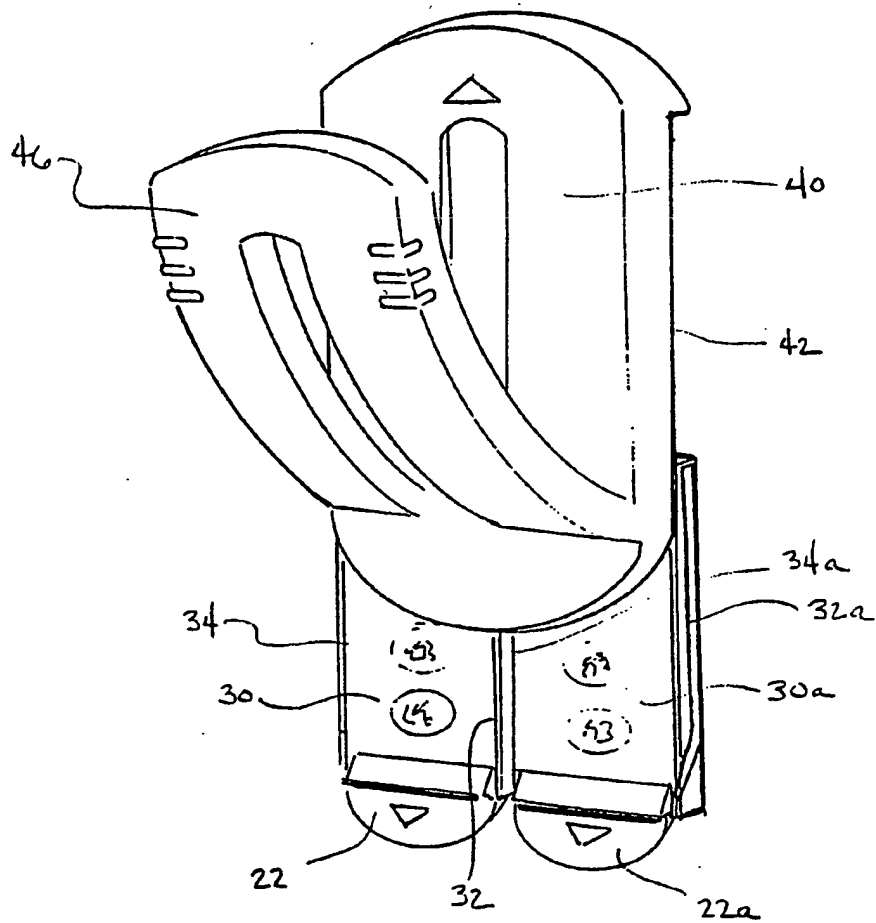


Fig. 10

717

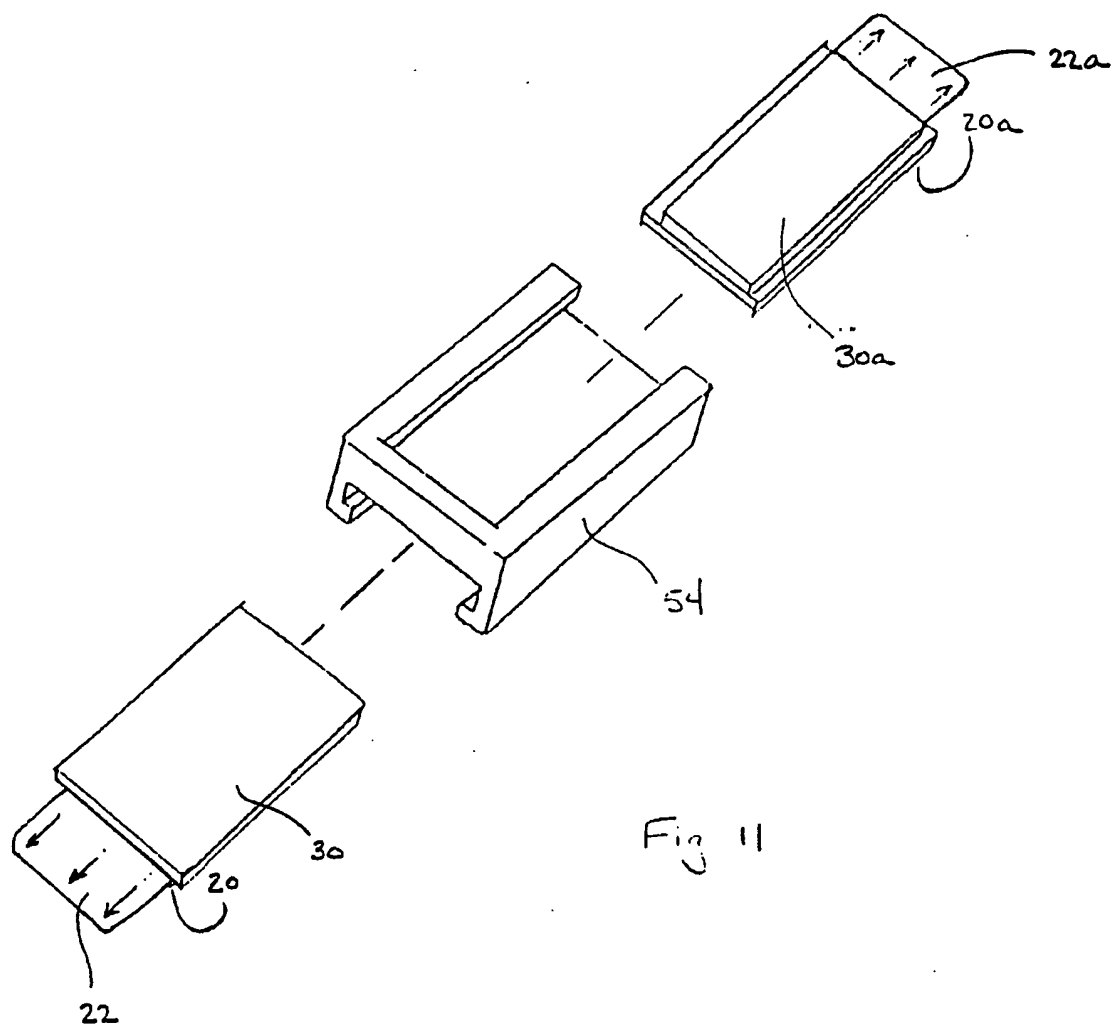


Fig 11



# INTERNATIONAL SEARCH REPORT

Intern. Application No  
PCT/US 93/02643

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 5 A47G1/17 F16B47/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 5 A47G F16B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE,C,689 462 (REAL) 21 March 1940 see page 2, line 88 - line 91; figures ---	1-15
A	WO,A,92 11333 (MINNESOTA MINING AND MANUFACTURING COMPANY) 9 July 1992 cited in the application see abstract ---	1-15
A	DE,B,10 22 773 (REAL) 16 January 1958 see column 1, line 41 - column 2, line 15; figures ---	1
A	US,A,4 181 553 (HOGG) 1 January 1980 see column 4, paragraph 60 - column 5, paragraph 15 ---	1
A	US,A,4 756 498 (FRYE) 12 July 1988 see column 3, line 23 - line 33; figures ---	1
-/--		

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

2 November 1993

Date of mailing of the international search report

30 -11- 1993

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+ 31-70) 340-3016

Authorized officer

SCHOLVINCK, T

# INTERNATIONAL SEARCH REPORT

Intern. Application No  
PCT/US 93/02643

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE,A,36 32 819 (BIENER) 31 March 1988 see figures ---	5-9
A	WO,A,91 06782 (ADAMS MFG. CORP.) 16 May 1991 see figures -----	5-9

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No  
PCT/US 93/02643

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-C-689462		NONE	
WO-A-9211333	09-07-92	AU-A- 9157591 CA-A- 2096935 EP-A- 0563272	22-07-92 21-06-92 06-10-93
DE-B-1022773		NONE	
US-A-4181553	01-01-80	US-A- 4106741	15-08-78
US-A-4756498	12-07-88	NONE	
DE-A-3632819	31-03-88	NONE	
WO-A-9106782	16-05-91	AU-A- 7740891	31-05-91